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(54) Title: A SEMICONDUCTOR DEVICE AND METHOD OF FABRICATING A SEMICONDUCTOR DEVICE

(57) Abstract: A method is proposed for the fabrication of the gate electrode of a semiconductor device such that the effects of gate depletion are minimized. The method is comprised of a dual deposition process wherein the first step is a very thin layer that is doped very heavily by ion implantation. The second deposition, with an associated ion implant for doping, completes the gate electrode. With the two-deposition process, it is possible to maximize the doping at the gate electrode/gate dielectric interface while minimizing risk of boron penetration of the gate dielectric. A further development of this method includes the patterning of both gate electrode layers with the advantage of utilizing the drain extension and source/drain implants as the gate doping implants and the option of offsetting the two patterns to create an asymmetric device. A method is also provided for the formation of shallow junctions in a semiconductor substrate by diffusion of dopant from an implanted layer contained within a dielectric layer into the semiconductor surface. Further, the ion implanted layer is provided with a second implanted species, such as hydrogen, in addition to the intended dopant species, wherein said species enhances the diffusivity of the dopant in the dielectric layer.

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## INTERNATIONAL SEARCH REPORT

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**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : H01L 21/425

US CL : 438/532, 558, 563, 559

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 438/532, 558, 563, 592, 657, 659, 660

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
NONEElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
NONE**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 6,069,061 A (LIN et al.) 30 May 2000, Figs. 2, 4A-4E, text in col. 4, lines 28 to col. 5, line 42.	1-2, 4, 6-7, 9 ----- 3, 5, 8, 10
Y	US 5,837,598 A (ARONOWITZ et al.) 17 November 1998, col. 4, lines 1-24.	3, 5
Y	US 6,288,403 B1 (HORSKY et al.) 11 September 2001, col. 2, lines 9-43.	8, 10, 26-27
X -- Y	US 3,607,449 (TOKUYAMA et al.) 21 September 1971, Figs. 11-13, col. 3, lines 42-66.	24-25, 29-30 ----- 26-28

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"G"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,801,086 A (LEE et al.) 1 September 1998, col. 3, lines 8-57.	28